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ABSTRACT

In 1992, a study was conducted at Golden West College (California) to determine the predictive validity of the Math Diagnostic Testing Project (MDTP) tests. A total of 1,137 students were tested in-class; 601 took the Algebra Readiness test, 376 took the Elementary Algebra test, and 160 took the Intermediate Algebra test. Two correlation coefficients indicating predictive validity were computed for each course (in the first correlation withdrawals were converted to failing grades, and in the the second withdrawals were deleted from the analysis). Only minor differences existed between the validity coefficients computed with the two approaches. The median predictive validity value across all levels was .37, which exceeded the standard established by the California community colleges. The utility of the test scores as predictors of student performance was also supported. A subsequent goal of the study was to determine how best to use the tests for making placement recommendations by identifying cutscores. The primary method for establishing cutscores involved comparing success rates for contrasting groups over a range of scores. The recommended cutscores were able to discriminate with a degree of confidence between students in the sample who were ultimately successful or unsuccessful. Data regarding factors that might also serve as predictors of success in mathematics courses, such as the reported grade earned in the student's last math course and the grade expected in the current course, were gathered by a questionnaire. As independent predictors, evidence indicated that these two indicators would serve approximately as well as would objective test scores. Attachments provide the initial student survey and a discussion of the adoption of revised placement rules. (JMC)

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# Implementation and Initial Validation of the MDTP Tests at Golden West College

Golden West College
Huntington Beach, CA

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Steven Isonio, PhD
February, 1992

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**Implementation and Initial Validation of the MDTP Tests at Golden West College**

Steven Isonio, PhD

Background/Description of the MDTP Tests

The Math Diagnostic Testing Project (MDTP) Tests consist of four objectively scored, multiple choice instruments designed to measure mathematical skills ranging from pre-Algebra through pre-Calculus. The tests offer diagnostic information in the form of subscores that represent particular skill areas deemed critical for success in targeted courses. The instruments were developed and are periodically revised by the Math Diagnostic Testing Project, a joint venture of the California State University and the University of California. After several years of development, the series of four tests was ready in 1986, and was then released to schools.

The MDTP tests are currently the most widely used placement instruments in the California Community Colleges. Additionally, they are used at all of the University of California campuses, and approximately half of the California State Universities. They have received positive reviews on both practical and technical grounds, and were the first placement instrument to gain provisional approval by the Chancellor's Office for use beyond July 1992.

Current Math Placement Scheme at GWC and the Need for MDTP

Assessment of mathematics skills for placement purposes at Golden West College is currently based upon a combination of information from the mathematics section of the Stanford Test of

Academic Skills (TASK-Math), and the Algebra test of the Mathematical Association of America (MAA-Algebra). A major shortcoming of these instruments for placement purposes at GWC is that they are capable of measuring only a limited range of math skills--from arithmetic through elementary algebra. Because of this shortcoming, the highest math class for which students can currently be recommended is Intermediate Algebra (Math 030), and any students who "top off" the scale are not provided with a specific course recommendation. Therefore a distinct advantage of the MDTP tests is that they provide assessment of higher level math skills and appropriate course placement recommendations for these skill levels.

An additional feature of the MDTP tests is that they offer diagnostic capabilities in the form of subscores with specific mastery levels. These subscores can be used to identify skill deficits in focused areas. Further, as local research on the tests continues, placement rules may be modified to incorporate these subscores into a multiple weighting scheme that leads to a placement recommendation. That is, for example, students who score below the range for recommendations into Intermediate Algebra on the Elementary Algebra test might be recommended to take Elementary Algebra if they show mastery in key areas such as exponents and polynomials, whereas those students whose scores indicate that they have not mastered these skill areas might be recommended to take Pre-Algebra. Table I presents a list of the areas covered by each of the tests for which subscores are available.

Table 1

The MDTP Test Battery: Number of Items and Diagnostic Subscores

| Test | Number of Items | Topics |
|---|---|---|
| Algebra Readiness | 50 | Integers<br>Fractions<br>Decimals<br>Exponents/Square Roots<br>Graphing |
| Elementary Algebra | 50 | Arithmetic Operations<br>Polynomials<br>Linear Equations and Inequalities<br>Quadratic Equations<br>Graphing<br>Rational Expressions<br>Exponents/Square Roots<br>Geometric Measurement<br>Word Problems |
| Intermediate Algebra | 45 | Elementary Operations<br>Rational Expressions<br>Exponents and Radicals<br>Linear Equations and Inequalities<br>Quadratic Polynomials<br>Graphing<br>Logarithms and Functions<br>Word Problems |
| Pre-Calculus | 40 | Rational Expressions<br>Exponents and Radicals<br>Linear Equations and Inequalities<br>Polynomials and Polynomial Functions<br>Functions<br>Trigonometry<br>Logarithmic and Exponential Functions<br>Word Problems |

Further, the MDTP tests have received somewhat positive reviews by the Center for Educational Testing and Evaluation, on behalf of the CCC Chancellor's Office. The MDTP technical manual (MDTP, 1991) presents results from a number of predictive validity studies conducted at CSU, UC, and Community College campuses. Predictive validity coefficients from these studies for the Algebra Readiness test range from the mid .30s to the high .40s. Similar values are reported for the Elementary Algebra and Intermediate Algebra tests. Validity coefficients range from .33 to .61 for the Pre-Calculus test.

## Overview of the Pilot Study

Interest in the MDTP tests has existed for years at GWC. In March of 1991, the GWC Math Department expressed its intention to eventually adopt the tests and the belief that implementation details and the initial system of cutscores should be empirically-based. Therefore the pilot study was planned during late Spring 1991; data collection (administration of tests and a brief questionnaire) took place during the Summer and Fall 1991 sessions. Data analysis began in early 1992 when course grades for Fall 1991 classes were first available.

## Method

A schedule for in-class pilot tests was developed from an examination of the course schedule. All testing was limited to the first week of classes, in order to avoid or minimize the effects of instruction in the class and to approximate as closely

as possible the sequence and timing of the assessment/placement process. Instructors of the selected classes were contacted and asked for permission to use an hour of class time to administer the test. Data were collected in 19 of the 20 scheduled class sections over the Summer and Fall sessions. A total of 1137 students were tested during the two sessions--601 took the Algebra Readiness test, 376 took the Elementary Algebra test, and 160 took the Intermediate Algebra test. Table 2 shows the number of students tested, by course and by test level.

As would be expected, there is a close correspondence between the number of students enrolled in the various courses and their representation in the pilot study data set. Since no data were collected for courses that would be appropriate for the Pre-Calculus (Level IV) test, no recommendations for its use are made, and implementation of this test will be delayed.

Table 2

Number of Students Tested, By Course and Test Level

| Course \ Test | I: Algebra Readiness | II: Element. Algebra | III: Inter. Algebra |
|---|---|---|---|
| Elementary Algebra (Math 010) | 601 | -- | -- |
| Plane Geometry (Math 020) | -- | 47 | -- |
| Intermediate Algebra (Math 30) | -- | 329 | -- |
| College Algebra (Math 115) | -- | -- | 30 |
| Trigonometry (Math 120) | -- | -- | 35 |
| Survey of Calculus (Math 130) | -- | -- | 73 |
| Finite Math (Math 150) | -- | -- | 22 |
| TOTALS | 601 | 376 | 160 |

## Results

Descriptive Statistics. The data collected for this pilot study are summarized in Table 3. These data constitute a first step toward the development of local norms for the MDTP test battery at Golden West College. The mean score and the coefficient of skewness provide a clue about the relative degree of difficulty of the tests. Positively skewed score distributions indicate that sampled students tend to find the test difficult. Thus, the Intermediate Algebra test was found clearly more difficult for students in courses that it targets (College Algebra, Survey of Calculus, Finite Math, and Trigonometry) than was the Elementary Algebra test for students in Geometry and Intermediate Algebra. In such relative terms the least difficult test was Algebra Readiness, for students in Elementary Algebra.

Predictive validity. The primary index of the strength of the relationship between test scores (predictor) and course grades (criterion) is the predictive validity coefficient (the correlation between predictor and criterion). Two correlation coefficients indicating predictive validity were computed for each course--one between the test scores and course grades with all withdrawals (Ws) converted to Fail (F), and the second between the test scores and course grades with withdrawals (Ws) deleted from the analysis.

Table 4 presents the results of these analyses. As can be seen, there are only minor differences between the validity

Table 3

Descriptive Statistics for Test Score, By Level

| Course | Test | N | Mean | Standard Deviation | Skewness |
|---|---|---|---|---|---|
| Math 010 | I | 600 | 30.07 | 7.55 | -.20 |
| Math 020 | II | 47 | 28.81 | 9.15 | .08 |
| Math 030 | II | 323 | 25.98 | 8.33 | .12 |
| Math 115 | III | 30 | 18.83 | 5.52 | .26 |
| Math 120 | III | 35 | 23.60 | 6.66 | .58 |
| Math 130 | III | 72 | 20.17 | 7.60 | .44 |
| Math 150 | III | 21 | 21.24 | 6.91 | .24 |

Table 4

Relationship Between Test Scores and Grades, By Course

| Course | Test Level | r (w/)* | r (w/o)* |
|---|---|---|---|
| Math 010 | I | .36 (485) | .34 (408) |
| Math 020 | II | .45 (35) | .72 (26) |
| Math 030 | II | .38 (239) | .39 (202) |
| Math 115 | III | .19 (25) | .26 (17) |
| Math 120 | III | .63 (27) | .62 (11) |
| Math 130 | III | .36 (54) | .31 (40) |
| Math 150 | III | -.09 (20) | .22 (17) |

Note: r (w/) = Correlation between score and grade, with "W" grades converted to "F"; r (w/o) = Correlation between score and grade, with "W" excluded.

coefficients computed for each course with the two approaches. With the exception of Math 150, that included only 17 students in the bivariate distribution that resulted in the lowest correlation, the median predictive validity value across all levels is .37, ranging from a low of .19 (for Math 115 with withdrawals included) to a high of .72 (for Math 020 with withdrawals excluded). Minimal standards are for predictive validity coefficients for placement instruments to be at least .35 (California Community Colleges, 1991). Evidence from the current analysis indicates that the MDTP tests meet and even exceed this standard at GWC. This is a critical step in the local validation of assessment instruments in that without at least a moderate overall relationship between test scores and course grades, a test would be no better at generating placement recommendations than would a random method of doing so. Indeed, given the attenuation of the validity coefficient due to less than perfect reliability of both the predictor and criterion, and the restriction of range due to the use of intact groups, the obtained predictive validity coefficients are particularly impressive.

Development of Placement Rules. Given the adequate overall relationship between test scores and course grades, the utility of the test scores as predictors of student performance is supported. The next issue is a very practical one--how best to use the tests for making placement recommendations. This involves identifying cutscores. Of course, no method of establishing cut scores is flawless. With typical predictive

validities of about .35, only about 10% of the variance in student performance is associated with the test scores. A great many factors not tapped by the tests, both systematic and not, contribute to course grades. The goal of the process, therefore, is to improve prediction of success relative to a system that does not include objective test scores.

The primary method used for establishing cutscores involved comparing success rates for contrasting groups over a range of scores. More specifically, the contrasting groups were defined in what has become the standard method--the "successful" group consisted of students who earned grades of A, B, or C, whereas persons with grades of D, F or W (withdrawal) were categorized in the "unsuccessful" group. Given this distinction, it was then possible to determine the proportion of students with specific scores, and hence for score ranges, that were successful. Candidate cutscores were then evaluated in terms of their ability to "predict" success (i.e., maximize the difference between success rates for persons scoring above that value and those scoring below it).

Table 5 details this "contrasting groups" approach for the case of the Algebra Readiness test (MDTP-I) for separating students who should be recommended to take PreAlgebra from those who appear ready for Elementary Algebra (that is, Math 005 versus Math 010). A segment of the score range near the chosen cutscore is depicted in the Table. The cutscore of 28 as the minimum for recommendation into Elementary Algebra is associated with 47.8% of the students below this point being successful and 76.4% of

Table 5

Analysis of Candidate Cutscores for Recommendation of Placement Into Elementary Algebra (MDTP TEST I--Algebra Readiness)

**Elementary Algebra Recommended for Scores >= 27**

| | <=26 | >=27 |
|---|---|---|
| Successful | 86 (47.5%) | 273 (74.8%) |
| Unsuccessful | 95 (52.5%) | 92 (25.2%) |

(Difference between proportions = 27.3)

**Elementary Algebra Recommended for Scores >= 28**

| | <=27 | >=28 |
|---|---|---|
| Successful | 97 (47.8%) | 262 (76.4%) |
| Unsuccessful | 106 (52.2%) | 81 (23.6%) |

(Difference between proportions = 28.6)
**This cut maximizes discrimination between successful and unsuccessful students

**Elementary Algebra Recommended for Scores >= 29**

| | <=28 | >=29 |
|---|---|---|
| Successful | 116 (51.8%) | 243 (75.5%) |
| Unsuccessful | 108 (48.2%) | 79 (24.5%) |

(Difference between proportions = 23.7)

those at or above this value being successful. The difference in "success rates" for students above and below the cutscore is 28.6%. Adjacent candidate cutscores produce similar values, but this difference is maximized by the chosen score of 28. This is the recommended cutscore for this case.

Table 6 provides supplemental information in support of the relationship between test scores and grades. Specifically, the mean test scores for key criterion (grade) defined groups--for students earning an A or B grade, a C grade, a grade of D or F, and those receiving W--are presented. The mean test scores for the highly successful students (those with A or B grades) is clearly greater than the mean values for students who earned C grades, who in turn tended to have higher scores than those with D or F grades. While the pattern is clearly not a perfect linear relationship, these data are consistent with the overall linear relationships between test scores and course grades, and also support the reasonableness of the recommended cutscore levels.

While scores at or above the cutscore level indicate skills necessary for success in the higher level course, it is not the case that all scores below the cutscore represent skills associated with success in the next lower level course. For example, a student who earns a very low score on the Intermediate Algebra test, while not recommended for Trigonometry, should probably also not be recommended for the Intermediate Algebra course. That is, there is a need for a "floor", of sorts, to the placement rule, a value below which students are either referred to low level courses or are referred for further evaluation.

Table 6

Mean Score For Key Grade-Based Criterion Groups, By Course

| Test/ Course | Grade(s) Earned | | | |
|---|---|---|---|---|
| | A/B | C | D/F | W |
| **Test I** | | | | |
| Math 010 | 33.0 | 28.9 | 27.7 | 26.6 |
| **Test II** | | | | |
| Math 020 | 32.2 | 26.2 | 22.3 | 27.7 |
| Math 030 | 28.9 | 24.0 | 24.2 | 23.7 |
| **Test III** | | | | |
| Math 115 | 20.3 | 18.8 | 17.0 | 18.7 |
| Math 120 | 27.3 | * | 20.7 | 21.1 |
| Math 130 | 24.9 | 17.2 | 20.9 | 17.4 |
| Math 150 | 22.1 | * | * | 26.3 |

* Sample size for this group is <= 5.

Initial values for this "lower cutscore" were identified as the score that corresponds to two standard deviation units below the mean of the distribution of scores earned by students in the target course on that test. That is, if a student's score is lower than two standard deviation units below the mean, s/he may have taken the inappropriate test and should therefore be referred for further evaluation.

The results of the analyses just described are presented in Table 7 in the form of recommended placement rules. As can be seen, scores of 28 or above on the Algebra Readiness (I) are associated with the recommendation to Elementary Algebra (Math 010); students with scores of 27 or lower will be directed to Pre-Algebra (Math 005). For the Elementary Algebra test (II), 24 or greater will be associated with placement into Plane Geometry (Math 020) and Intermediate Algebra (Math 030); students with scores of 9 through 23 will be placed into Elementary Algebra (Math 010). Finally, scores of 8 or lower on this test will yield a recommendation to Pre-Algebra (Math 005). The Intermediate Algebra test (III) will place students scoring 28 or higher into Trigonometry (Math 120), 21 and 19 are the minimum score for placement into Survey of Calculus (Math 130) and College Algebra (Math 115), respectively. The lower ranges of scores and associated recommendations are, 7-18 for Intermediate Algebra (Math 030), and 6 or lower indicating the need for further evaluation (e.g., a more appropriate placement test). Of course, students also may take courses at a level equal to ro lower than the highest course into which they placed.

Table 7

Recommended Initial Placement Rules for MDTP Tests I, II, and III

| Test | Score Range | Recommended Placement |
|---|---|---|
| **I:** | **Algebra Readiness** | |
| | Score Range | Recommended Placement |
| | 28 - 50 | Elementary Algebra (Math 010) |
| | 0 - 27 | PreAlgebra (Math 005) |
| **II:** | **Elementary Algebra** | |
| | Score Range | Recommended Placement |
| | 24 - 50 | Plane Geometry (Math 020)<br>Intermediate Algebra (Math 030) |
| | 9 - 23 | Elementary Algebra (Math 010) |
| | 0 - 8 | PreAlgebra (Math 005) |
| **III:** | **Intermediate Algebra** | |
| | Score Range | Recommended Placement |
| | 28 - 45 | Trigonometry (Math 120)<br>(also, Math 130, Math 115) |
| | 21 - 45 | Survey of Calculus (Math 130)<br>(also, Math 115) |
| | 19 - 45 | College Algebra (Math 115) |
| | 7 - 18 | Intermediate Algebra (Math 030) |
| | 0 - 6 | Further Evaluation |

The ability of recommended cutscores to discriminate between students in the sample who were ultimately successful or unsuccessful is summarized in Table 8a. The recommended cutscore for the Algebra Readiness test corresponds to the point below which slightly over half (52.2%) of the persons in Elementary Algebra (Math 010) were unsuccessful and over three-fourths (76.4%) of those above the cutscore are successful. The recommended cutscore for the Elementary Algebra test divides the sample of Plane Geometry (Math 020) students into those below the cut who have a success rate of only 28.6% and those above with a success rate of 76.0%. This cutscore divides the sample of Intermediate Algebra (Math 030) students into those below the value who had a success rate of 49.3% and those above with a success rate of 70.6%. The recommended cutscores for the courses associated with placements from the Intermediate Algebra test produce differentiations as clear as those outlined above for the two lower level tests. This information is detailed in Table 8b.

Relationships Of Other Indicators With Grades. Data regarding factors that might also serve as predictors of success in mathematics courses were gathered by a questionnaire (see Appendix). Two such indicators warranting particular attention are the reported grade earned in the student's last math grade and the grade expected in the current course. Bivariate correlations between each of these variables and course grade are presented in Table 9 for the various levels of math courses sampled. There is a clear tendency for these other indicators to be more strongly related to course grade in the higher level

Table 8a

Ability of Optimal Cutscores to Discriminate Successful/ Unsuccessful

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**Test I: Performance in Math 010**

| | Cutscore | |
|---|---|---|
| | <=27 | >=28 |
| Successful | 47.7% | 76.4% |
| Unsuccessful | 52.2% | 23.6% |

**Test II: Performance in Math 020**

| | Cutscore | |
|---|---|---|
| | <=23 | >=24 |
| Successful | 28.6% | 76.0% |
| Unsuccessful | 71.4% | 24.0% |

**Test II: Performance in Math 030**

| | Cutscore | |
|---|---|---|
| | <=23 | >=24 |
| Successful | 49.3% | 70.6% |
| Unsuccessful | 50.7% | 29.4% |

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Table 8b (continued)

Ability of Optimal Cutscores to Discriminate Successful/ Unsuccessful

**Test III: Performance in Math 115**

| | Cutscore <=18 | >=19 |
|---|---|---|
| Successful | 53.8% | 78.6% |
| Unsuccessful | 46.2% | 21.4% |

**Test III: Performance in Math 120**

| | Cutscore <=27 | >=28 |
|---|---|---|
| Successful | 17.4% | 87.5% |
| Unsuccessful | 82.6% | 12.5% |

**Test III: Performance in Math 130**

| | Cutscore <=20 | >=21 |
|---|---|---|
| Successful | 45.2% | 73.3% |
| Unsuccessful | 54.8% | 26.7% |

Table 9

Relationships Between Reported Last Math Grade and Current Grade, and Expected Grade and Current Grade

| Course | Test | r (LstGrade) | r (ExpGrade) |
|---|---|---|---|
| Math 010 | I | .08 | .13 |
| Math 020 | II | .51 | .22 |
| Math 030 | II | .42 | .47 |
| Math 115 | III | .57 | .23 |
| Math 120 | III | .30 | .29 |
| Math 130 | III | .43 | .46 |
| Math 150 | III | .31 | .33 |

Note: r (LstGrade) refers to correlation between the reported grade earned in the student's last math class and the grade earned in the current class. r (ExpGrade) refers to correlation between the grade the expected to earn in current class, and the actual grade earned.

classes. Further, the overall average relationship with course grade is slightly stronger for the last math grade than for the expected grade, but the difference is not sizeable (median correlations across courses are .42 for the former and .33 for the latter). It is important to note that, as independent predictors, evidence indicates that these two indicators would serve approximately as well as would objective test scores.

Prediction based upon multiple indicators, each at least moderately correlated with the criterion, is typically superior to prediction based upon a single indicator. The positive findings concerning the relationships between both last math grade and expected grade and course grade suggest that these and similar variables may be useful as additional predictors in future, more comprehensive, placement models.

As of December 1991, with the implementation of the Computerized Assessment and Placement Program (CAPP), the GWC Assessment Center now can regularly gather, store locally, and easily retrieve a broad range of information in addition to test scores. Candidate predictors such as previous experiences math courses, expectations, and other variables can be evaluated concerning their appropriateness as predictors of success in math classes. Regression-based, multiple indicator placement rules can be developed for the full range of mathematics courses. As noted earlier, some of the diagnostic subscores might also be a part of these models. In any case, some of the data collected with the questionnaire for this pilot study suggest that, as more data are collected and the necessary analyses are performed,

effective multiple indicator models can certainly be developed.

## Summary and Discussion

In summary, there is clear evidence of the predictive validity of the MDTP tests at GWC. The median value for these coefficients for courses that will be a part of initial placement rules is approximately .37. This value exceeds the minimal standard for predictive validity of assessment tests for placement purposes in California Community Colleges. Sets of placement rules for test levels I, II, and III were developed. A variety of lines of evidence supporting the reasonableness of these placement recommendations were presented in this report.

Further, it is critical to point out that the placement rules developed and outlined above are recommendations for <u>initial</u> implementation of the MDTP tests at Golden West College. They will be monitored and adjusted as needed. Additionally, a number of followup and supplemental studies are required. There is a need to evaluate the extent to which disproportionate impact results from the use of these tests. A related issue that must be investigated is that of differential validity. Specifically, this issue involves the relative validity of the tests as placement tools for a number of important subgroups. Finally, as outlined above, models with multiple predictors will be developed and the optimal use of diagnostic subscore information must be determined.

## References

California Community Colleges (1991). Standards, Policies and Procedures for the Evaluation of Assessment Instruments Used in the California Community Colleges.

California State University and University of California (1991). Math Diagnostic Testing Project--User Manual.

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# A P P E N D I X

MATH DIAGNOSTIC TESTING PROJECT: PILOT STUDY
Student Survey

1. How many years of math did you complete in high school?

   a. less than one
   b. one
   c. two
   d. three
   e. four

2. How many math courses have you completed in college?

   a. none
   b. one
   c. two
   d. three
   e. four or more

3. What was the last math class that you completed? (Please indicate the name, not the number of the class).

   _____

   _____

4. What grade did you receive in the last math class that you completed?

   a. A
   b. B
   c. C
   d. D
   e. Withdrawal or incomplete
   f. F

5. What grade do you expect to earn in this math class?

   _____

Your Social Security Number: _____

**Implementation and Initial Validation of the MDTP Tests at Golden West College: Supplement**

Steven Isonio, PhD

Background.

The process of evaluating predictive validity and developing placement rules for the Math Diagnostic and Testing Project (MDTP) instruments was described in the primary report. The study on which that report was based yielded recommendations for initial placement rules for three of the tests in the battery. Data were gathered and analyzed that are relevant to these placement recommendations involving three tests of the four MDTP tests, and seven mathematics courses at GWC. Implementation of the fourth MDTP test, and assessment for placement into higher level math courses will be will be delayed, pending the collection and analysis of additional data.

Subsequent Developments.

During two meetings to discuss MDTP implementation with the GWC Math Department (in early February 1992), some concerns were expressed that the recommended cut scores for differentiating Math 005 from Math 010 placements (with the Algebra Readiness test) and between Math 010 and Math 030/Math 020 placements (with the Elementary Algebra test) might be too high. These concerns were largely based upon observations that while the proportion of successful students above the cutscore was in the mid-70% range, it was nearly 50% for the group below the cutscore. The expectation was that the placement rule should result in a clearer majority of students below the cutscore who are

unsuccessful. Subsequent analyses revealed that the ability to discriminate between successful and unsuccessful students was not markedly poorer for scores just below the values originally recommended for Math 010 and Math 030 (see Table 1). That is, in the case of Math 010, a cut score of 25/26 (instead of 27/28) separates the sample into an upper group that has a success rate of 73.2% and a lower group with a success rate of only 46.0%. In the case of Math 030, the success rates for these two groups (defined by a 21/22 cut instead of 23/24) is 67.5% for the upper group and 50.9% for the lower group.

Since the overall pass rates were in the mid-60%'s for the classes in the sample, contingency tables were developed that excluded students earning "C" grades from the "success" group to assess the ability of the cutscores to differentiate between these two contrasting groups (see Table 2). This analysis revealed that the new cutscores are clearly capable of making the differentiation.

In light of these analyses, and since lower cutscores make it possible to monitor the performance of students in the band of scores recommended to the higher level course, the GWC Math department decided to adopt the placement rules depicted in Table 3. Students scoring in the lower region of the upper placement can be closely monitored; if their performance in class is markedly lower than that of students in the higher regions, the cutscore can be lowered. Conversely, if their success rate is comparable to the others in the range, the cut score can be maintained.

Summary and Recommendations.

The primary report and this supplement document the process of pilot testing the MDTP tests at Golden West College. Strong evidence for predictive validity is presented and the development of placement rules based upon a combination of empirical and judgmental approaches is described.

Additional research is needed in the following areas:

--Cross validation with separate samples.

--Analysis of differential validity and disproportionate impact in placement recommendations.

--Development of a comprehensive placement model based upon multiple measures

--Monitor rates at which students select the various MDTP tests as well as placement rates to assist planning and scheduling

--Develop a placement rule and establish predictive validity for MDTP test number 4, Pre-Calculus

Table 1

Analysis of New Cut Scores For Math 010 and Math 030

Math 010 -- Algebra Readiness Test

| Outcome | Cutscores | |
|---|---|---|
| | <= 25 | >=26 |
| Successful | 46.0% | 73.2% |
| Not Successful | 54.0% | 26.8% |

Math 030 -- Elementary Algebra Test

| Outcome | Cutscores | |
|---|---|---|
| | <= 21 | >=22 |
| Successful | 50.9% | 67.5% |
| Not Successful | 49.1% | 32.5% |

Table 2

Analysis of New Cut Scores For Math 010 and Math 030, With "C" Grades Excluded From Successful Group

Math 010 -- Algebra Readiness Test

| Outcome | Cutscores | |
|---|---|---|
| | <= 25 | >=26 |
| Successful | 26.4% | 65.7% |
| Not Successful | 73.6% | 34.3% |

Math 030 -- Elementary Algebra Test

| Outcome | Cutscores | |
|---|---|---|
| | <= 21 | >=22 |
| Successful | 36.9% | 66.7% |
| Not Successful | 63.1% | 33.3% |

Table 3

Placement Rules for MDTP Tests I, II, and III, As Adopted

| Test | Score Range | Recommended Placement |
|---|---|---|
| **I:** | **Algebra Readiness** | |
| | 26 - 50 | Elementary Algebra (Math 010) |
| | 0 - 25 | PreAlgebra (Math 005) |
| **II:** | **Elementary Algebra** | |
| | 22 - 50 | Plane Geometry (Math 020)<br>Intermediate Algebra (Math 030) |
| | 9 - 21 | Elementary Algebra (Math 010) |
| | 0 - 8 | PreAlgebra (Math 005) |
| **III:** | **Intermediate Algebra** | |
| | 28 - 45 | Trigonometry (Math 120)<br>(also, Math 130, Math 115) |
| | 21 - 45 | Survey of Calculus (Math 130)<br>(also, Math 115) |
| | 19 - 45 | College Algebra (Math 115) |
| | 7 - 18 | Intermediate Algebra (Math 030)<br>Plane Geometry (Math 020) |
| | 0 - 6 | Further Evaluation |



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